

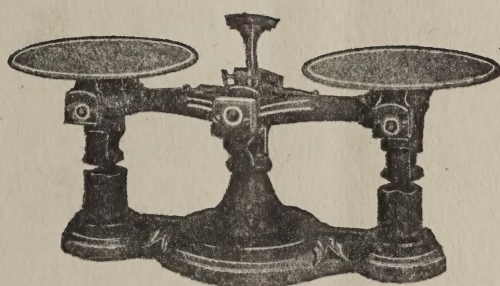
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Proceedings of the Meeting of the American Scale Men's Association

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Held in
Saint Louis, Missouri
at the American Hotel
Annex, June 6 and 7
1914

Proceedings of the Meeting
OF THE
American Scale Men's
Association



HELD IN ST. LOUIS, MISSOURI
AT THE
AMERICAN HOTEL ANNEX

June 6 and 7, 1914

OFFICERS

F. S. ELLIOTT, President

H. M. BOWLES, Secretary

J. B. ANDERSON, Treasurer

The regular meeting of the American Scale Men's Association was held at the American Hotel Annex, June 6th and 7th, 1914.

Mr. F. S. Elliott, president, called the meeting to order at 2:30 p. m. with the following present:

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J. B. Anderson	Mena, Ark.	K. C. S. Ry., Treasurer.
C. C. Royse	St. Louis, Mo.	Mo. Pac. Ry.
J. Heidenfelder	Pacific, Mo.	Mo. Pac. Ry.
R. J. Steel	Pacific, Mo.	Frisco R. R.
Rudolph Grundman	Springfield, Mo.	Frisco R. R.
J. A. Pallardy	St. Louis, Mo.	Fairbanks, Morse & Co.
Wm. Proehl	St. Louis, Mo.	Fairbanks, Morse & Co.
R. S. Burnside	Parsons, Kan.	M. K. & T. Ry.
C. L. Wynne	St. Louis, Mo.	Mo. Pac. Ry.
F. S. Elliott	St. Louis, Mo.	Mo. Pac. Ry., President.
Henry Allen	Ft. Scott, Kan.	Frisco R. R.
Wm. G. Klotz	Houston, Tex.	Southern Pacific Ry.
John Simcosky	Nevada, Mo.	Mo. Pac. Ry.
J. F. Pallardy	Kirkwood, Mo.	Fairbanks, Morse & Co.
Wm. Rosenmeier	Howell, Ind.	L. & N. R. Ry.
C. E. Stover	Coffeyville, Kan.	Mo. Pac. Ry.
John T. Heard	Birmingham, Ala.	L. & N. R. Ry.
T. E. Kenworthy	Peru, Ind.	Wabash R. R.
W. H. Ragsdale	Palestine, Tex.	I. & G. N. Ry.
A. Christopher	Nashville, Tenn.	N. C. & St. L. Ry.
C. A. Johnson	Rutland, Vt.	Delaware & Hudson Ry.
G. J. Gerhardt	Batesville, Ark.	Mo. Pac. Ry.
Wm. Taake	Centralia, Ill.	I. C. R. R.
Wm. Rivett	Lincoln, Neb.	C. B. & Q. R. R.
Wm. Sligar	Centralia, Ill.	I. C. R. R.
Will Ball	Chicago, Ill.	Streeter-Amet W. & R. Co.
A. M. Weinbrecht	Terre Haute, Ind.	Vandalia R. R.
W. E. Dunlap	Cincinnati, Ohio	B. & O. R. R.
R. Reed	St. Louis, Mo.	Mo. Pac. Ry.
D. J. McCarthy	Oelwein, Iowa	C. G. W. Ry.
H. S. Jackson	Chicago, Ill.	Chicago Board of Trade.
G. H. Farrell	Oelwein, Iowa	C. G. W. Ry.
F. H. Schlinkert	St. Louis, Mo.	Mo. Pac. Ry.
H. G. Mack	Columbus, Ohio	Vandalia R. R.
W. S. Chapman	Indianapolis, Ind.	Vandalia R. R.
B. B. Gordon	Logansport, Ind.	Vandalia R. R.
Otto C. Luecke	St. Louis, Mo.	Standard Scale & Fixture Co.
J. W. Skelton	Lincoln City, Ind.	Southern Ry.
N. H. LaFountain	Chicago, Ill.	C. M. & St. P. Ry.

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Henry Froggatt.....	East St. Louis, Ill.....	Howe Scale Co.
Elmer Campbell.....	St. Louis, Mo.....	Howe Scale Co.
Tony Caseleggio.....	St. Louis, Mo.....	Howe Scale Co.
J. A. Bugnoll.....	Webster Groves, Mo.....	Howe Scale Co.
James M. Whittle.....	St. Louis, Mo.....	Howe Scale Co.
W. S. Hanley.....	Bogalusa, La.....	N. O. & G. N. Ry.
F. V. Roy.....	St. Louis, Mo.....	Fairbanks, Morse & Co.
T. Edw. Morrison.....	St. Louis, Mo.....	Fairbanks, Morse & Co.
John Dower.....	St. Louis, Mo.....	Merchants Exc., Weighing Dept.
Chas. W. Hamilton....	East St. Louis, Ill.....	Mo. Pac. Ry.
R. S. Bohannon.....	Ensley, Ala....	Bohannon-Dugger-Easer Joint Co.
R. J. Dean.....	Dallas, Tex.....	T. & P. Ry.
James McGregor.....	St. Louis, Mo....	Merchants Exc., Weighing Dept.
A. G. Zeibel.....	Oelwein, Iowa.....	C. G. W. Ry.
H. M. Bowles.....	St. Louis, Mo....	Fairbanks, Morse & Co., Sec'y.

Mr. John T. Heard of Birmingham, Ala., and Mr. R. J. Dean of Dallas, Texas, were accompanied by their wives at the afternoon session.

Address of Welcome

By F. S. ELLIOTT, PRESIDENT.

Ladies and Gentlemen:

In behalf of St. Louis and the members of this association I welcome you. The plan was to have the mayor of the City of St. Louis present at this meeting to welcome you in behalf of St. Louis, but on account of a prior engagement was unable to attend, but understand that you are just as welcome as though he was with you.

You all understand the object of this association pretty thoroughly, I believe. I do not have to explain its motive. We have some very interesting papers here that we will have read and take up the afternoon in that way. In the evening we will have a business session for members only and tomorrow we will have an excursion by courtesy of the Missouri Pacific Railway, to inspect their Twin Hump Scales at Dupon, Illinois, and from there to Pacific, Missouri, to inspect their Master Scales. This special train was tendered by the courtesy of the Missouri Pacific Railway, and all who are entitled to transportation were invited to secure it, but on account of the Interstate laws the railroad is not allowed to carry anyone except railway employes and those who are not employes will have to purchase tickets. Anyone that is not entitled to transportation will give their name to the secretary, and he will secure all the tickets for you and meet you at the train in the morning. Please attend to this during the afternoon sometime. There are no conditions connected with the courtesy of the Missouri Pacific at all. A delegate asked me this morning if we had to guarantee a certain amount of paid tickets in order to get them to run the train and I answered that it was perfectly free in every respect, but that the law compels us to charge the public. This train will leave the Union Station about 8:00 a. m., and get back to St. Louis about 2:30 in the afternoon and then there will be a banquet here in this hall.

The president appointed Mr. John Simcosky Train Master for the special train, Sunday, June 7th.

I will now introduce to you Mr. C. A. Johnson from Rutland, Vt., who has a paper he will read, which was as follows:

INSTALLATION, RESEALING AND MAINTENANCE OF RAILROAD TRACK SCALES.

The subject of track scale installation and maintenance has been quite thoroughly covered in pamphlets issued by the "National Association of Scale Experts" and the "American Railway Association."

I will touch only briefly on location, construction, etc., before taking up re-sealing and leverage.

In regard to location, it seems to me, that yardmasters, and persons who have work to do in railroad yards, should be consulted as to the location of track scales. They should certainly be placed where the

weighing can be done quickly, and with the least possible handling of cars not to be weighed.

Made land and swampy places should be avoided as far as possible for sites, but if it is necessary to construct on soft soil, not less than thirty inches of reinforced concrete should be used as a footing, the reinforcement to be second-hand 80 or 90 pound rails, fifteen inches apart longitudinally, with joints broken, and four rails transversely under each section of the bearing points.

In case of quick-sand, piles should be driven in before placing the footing to support and steady it. On clay soil a layer of 5 or 6 inches of cinders well tramped down, and sub-drained with four-inch tile is advisable, before the cement is put in. A 1-3-6 mixture is sufficiently strong for the footing and side and end walls, but the tops should be finished with a stronger mixture, and the piers finished with three or four inches of 1-2 mixture. The foundation of a track scale should not be a question of how cheaply, but how well it may be built.

STYLE OF SCALE:

The new 150-ton suspended bearing rigid deck scale has been adopted by our road as a standard, the pit of which is 64 by 10½ feet, and 7 feet deep, with a 6 foot overhang on each end, making the working platform 52 feet.

This scale has a type-registering beam with no counterpoise weights, except a type-registering bottle weight drawing 50 tons.

We are not using automatic devices on our track scales as yet for several reasons. Our company objects to paying a royalty on these devices, and nothing has appeared on the market, as far as we can ascertain, that is satisfactory. These devices are so complicated and delicate of construction, that an expert should be in constant touch with them to keep them in proper adjustment.

There has been no improvement over the old graduated beam and poise for accurate weighing, except perhaps the type-registering device.

The quick-weighing devices are convenient for approximate weighing, but if material is to be weighed correctly, it should come to a dead stop, and be free at both ends. The working parts of a scale must have time to adjust themselves to the load before a correct reading can be had. The vibration of a car in motion interferes with this adjustment, and the car begins to leave the scale before the accurate weight can be ascertained.

I have tested scales, of which the platforms were on a 1¼% grade by letting the test-car drop down over at a slow speed, and noticed no variation in the beam. But on re-testing, and stopping the car over each section, there was a variation of 200 to 300 pounds.

A substantial, well-built foundation is the first thing to be considered in a track scale, or any other scale for that matter. And the installation of the scale itself should be under the supervision of a practical man, so that all stands, both main lever and fulcrum, will be placed in proper adjustment, and level both ways, that all levers will be level, all connecting loops plumb both ways, and in fact all parts placed in proper position.

TESTING, RESEALING AND MAINTENANCE:

My experience has taught me that it makes no difference whether a track scale is set up, and sealed out in the factory, and all parts match-marked, and absolute distances given between bearing points, or each main lever sealed separately, making them interchangeable, and each extension lever sealed to fit into its particular place. In either case a scale should be correct when set new. The first test should be made as the scale is found in ordinary every-day use.

If there is a variation between sections, or if the scale is not weighing the standard correctly, then each bearing and lever should be carefully examined to ascertain the cause. There may be an obstruction somewhere, some substance worked into the bearings, a bind at the edge of the platform, or ninety-nine other things causing friction enough to make the variation. If the sealer is certain that all parts are in proper position, no broken parts, no bind, or no obstructions whatever, and that the cause for any variation is in the leverage, then, and not until then, is he justified in moving a nose-iron.

When it becomes necessary to move a nose-iron, care must be taken to keep all connecting links plumb. In most track scales (Fairbank's pattern), there are two nose-irons, one in the end extension lever, and the other directly under it in the center extension lever. These must both be moved, keeping the pivot edges and connecting links plumb, if the leverage is to be changed in the end section. Otherwise a drawing of one lever against another will occur, which will counteract the change of leverage intended.

The connection link between these levers is so short, about 6 inches, that it is absolutely necessary to keep it plumb. The other connection links, or shackles as they are sometimes called, are longer, and the fact of their being an eighth of an inch or so out of plumb is not noticeable, but the principle of all connection between levers being plumb must be rigidly adhered to.

The laws of gravitation must not be overlooked or interfered with in manipulating any scale. If the leverage cannot be changed enough by moving the nose iron, then the lever must be taken out, and the short arm lengthened, as the case may require, by grinding the platform pivot or the pivot, that receives the load. This can be done only by using proper gauges, range sticks and straight edges. Each lever has a certain range, i. e., the pivot edge, that receives the load is slightly raised above a line drawn between the other two pivots, or an extension of this line in a first class lever.

However, the proper thing to do, if the levers cannot be sealed by moving the nose irons, is to take out the scale completely, and send it to a scale repair shop to have it re-pivoted and the levers resealed. The wearing flat or round of the pivot edge not only reduces the range, but, as the pivot turns on the bearing, it causes a change of leverage, so that it is impossible to move a nose iron enough to change perceptibly the leverage. Only when all pivots are reasonably sharp can a scale be satisfactorily resealed in the pit.

In case a broken pivot is found in a scale, that is otherwise in good condition, a new one should be formed and fitted as perfectly as possible. A temporary gauge can be made if the exact pivot distance can be ascertained, and the new pivot edge made exactly parallel with the other one. A man, to do this properly, should be a good bench-workman, and capable of tempering pivots properly.

In resealing, the different sections must be brought within the tolerance required by the government, which is two-tenths of one per cent. In a 60,000 pound test, this means an allowance of 120 pounds.

The U. S. Government inspectors have adopted the plan of numbering the sections from left to right, as the inspector faces the scale standing on the side next to the beam. I wish right here to give the result of tests made on a 100-ton, five section track scale in Oneonta, N. Y., April 10, 1914.

First Test—60,000 pound test.

Section	1	2	3	4	5	Average
	59,450	59,450	59,700	59,820	60,000	310 lbs. weak

Inspection of levers, bearings, etc., was made, and all irons were found in their proper positions, and nothing interfered with the working of the scale. Nose irons were moved to strengthen the weak end.

Second Test:

Section	1	2	3	4	5	Average
	59,800	59,800	59,980	59,980	60,000	88 lbs. weak.

Still further changes in leverage were made.

Third Test:

Section	1	2	3	4	5	Average
	60,000	60,000	60,020	59,980	60,000	Correct.

Slight Changes.

Fourth Test:

Section	1	2	3	4	5	Average
	60,020	60,020	60,040	60,000	60,020	20 lbs. Strong.

This scale is seven years old, and had never been resealed to a 60,000-pound standard before. Previous tests were made with a 40,000-pound standard, which did not show a variation in proportion to the 60,000-pound test. We think it advisable to leave a scale a trifle strong when resealing, as a scale grown weak instead of strong in use.

LEVERAGE:

Sealing and resealing are factory terms, and mean simply, that the levers or scales are in condition to receive a stamp of approval.

Track scales are made up of 1st and 2nd class levers. The 3rd class rarely enter into their construction, and then only to reduce the multiplication of the scale as a whole. The main levers, the end extension levers and the shelf lever, if there is one, are second class. The center extension, even lever (if one is used), fifth lever and beam are first class, in a scale of the Fairbank's pattern. All levers in a Howe scale are 2nd class except the beam.

The dividing point of all levers is the edge of the fulcrum pivot. This fact must be remembered in figuring the leverage of a scale. Each arm forms the radius of a circle with the fulcrum pivot edge as a common center.

Theory would place all pivot edges on a straight horizontal line, but practice forces us to place the pivot edge, that receives the load from one to two degrees of the circle above the line connecting the fulcrum and point pivots. This we call "range," and is to overcome friction and any possible deflection or bending of levers when loaded. Leveling of levers should be confined to the long arm, placing the point pivot a trifle above

if anything, so that as a lever moves it will approach a level rather than go out of level. Both arms lengthen, as the lever moves, until they pass the level position, then the long arm, which arrives their first, begins to shorten while the short arm is still lengthening. All levers, properly built, have this peculiarity, and it has been found necessary to do this, so that the scale as a whole will have a proper sensitiveness not only when balanced empty, but when loaded to full capacity.

If at any time too much or too little range has been put into the levers, it may be overcome by changing the range in the beam, shelf lever or some one lever, over which the entire weight is transmitted.

The line of pivot edges in the beam passes very nearly through the center of gravity of that lever, but not necessarily so in other levers. The travel of the poises is on a surface parallel to the long arm, otherwise the center of gravity of the beam as a whole would change as the poises are moved.

The different sized balance balls, used on the beams, are placed there to govern to a certain extent the center of gravity of the beam as well as to change the balance.

In order to test the poises on the beam properly, one must know the multiplication of the scale. This may be ascertained from the maker, or by measuring the levers as closely as possible, and computing it. Approximate multiplication can be obtained by hanging a one-pound weight on the point of the beam, and putting enough standard weight on the platform to balance it. Then the following formula may be of service in computing the poise:

As the travel of the poise in inches is to the long arm of the beam in inches, so is the weight required on the counter-poise to balance the weight on the platform indicated at the extreme end of the graduation, to the weight of the poise.

EXAMPLE:

Travel of poise grad. to 60,000 lbs.	Long arm of beam.	Weight at counterpoise.	Weight of poise.
37.25 in.	54 in.	11.156 lbs.	15.72 lbs.

If the notches on the main beam require resealing, it will be necessary to have fractional weights to correspond to each notch. Then the notches may be filed back or forward as the case requires, until each step in the graduation is perfected.

If a test car is not available, a standard may be made up, providing 1000, more or less, pounds in standard weights are at hand. Put the weights on a push car, get a balance, remove the weights and replace with any old iron, until the same balance is secured, and so on until the desired standard is made up. Or any quantity of material weighed on a common portable or dormant scale, that has been found to be correct, can be used for a standard. No scale is ever to be tested, unless the standard used is known to be absolutely correct.

Mr. Johnson was applauded for his efforts in preparing the paper.

Chairman arose and made the following remarks after the reading of paper by Mr. Johnson:

We thought that a good many of the delegates and guests would like a picture of this gathering and we have secured a photographer who will take a picture of the train with delegates lined up along side of it and the cost will be \$1.50 a picture; a very low rate. The photographer

wants to know this evening about how many would want to get the picture so that he would be justified in taking the same.

Mr. Bowles, Secretary, requested those present who desired to have a picture to so indicate on a ticket which was being passed around.

The president then introduced Mr. J. B. Anderson, Inspector of the Kansas City Southern Railroad who had a paper which by request was read by the secretary.

EXHIBIT No. 1.
AMERICAN SCALE MEN'S ASSOCIATION,
JUNE 6th, 1914.

In this exhibit I will endeavor to give some essential facts that exist in my mind, through experience, regard to installing and maintaining Railroad Track Scales. These facts are but few out of many, and very brief.

A recommendation has been adopted by the American Railway Association, and have provided a standard to which railroads can work, and in so doing I doubt not in the least but there were some of the best scale experts and engineers present to give their views and figures.

This is all very good as far as it goes, as to selection, design, capacity and length, but as to location of Track Scales, which depends so much on conditions of yards, grade curvings, leads to classification track and for quick dispatch of cars that are weighed, there is no one that can be of better assistance to the engineers in selecting location for new track scales in a railroad yard than a well experienced yardmaster, one who has had charge of switching in the yards and knows the best and quickest dispatch of cars, to not interfere with other tracks, and the presence of the Scale Inspector or Scale Expert, who has charge of the maintenance of scales, as in many instances scales are located too near a curve, incoming on the scales, where the trucks do not have room or time to right themselves before getting on the scales.

Second: On tracks where there is much switching done over the scales, especially at coal mines, sand or gravel pits, or places where open cars are handled.

Third: To enter a street crossing, switch or cut-over in the yard where the proper length of leads cannot be had.

Fourth: Where drainage cannot be obtained only by hand pump, as this is a very unsatisfactory feature, as the water is seldom pumped out, only when the Scale Inspector happens around, or those in charge hearing of him being on his way there.

The above notations, which are but a few out of many objectionable locations for scales, adds extra cost of maintenance and extra cost in switching, which can be overcome if engineers, yardmasters and scale men work in conjunction in selecting locations for scales.

INSTALLING OF NEW SCALES.

I find the first important part is to acquaint yourself with the blue prints and get familiar with all parts of the scales. After this is done it comes as easy to install a set of track scales as it is for a student to recite a well-learned lesson.

Be sure your center and cross sections are properly and correctly marked out, and be careful in preserving these marks as these will have

to be repeatedly referred to, from the time the first spade of dirt is removed until the last rail is placed.

The work of installing track scales is in a good start, as the old saying, a good beginning makes a good ending, and to make a good beginning, have every part square, plumb and level, all through the work, when the excavation is done and the drain properly put in, so during the work heavy rains will not leave water in the pit to hinder workmen, and soften the banks and foundation of the scale pit, before finished.

In placing of concrete the greatest care should be taken in mixing and distributing the concrete properly, and for this experienced men should be employed. Good mechanics should be employed in setting the forms, anchor bolts and stay irons, men who are able to make accurate and correct measurements, and keep all parts plumb, square and level.

As to ventilation, this should not be forgotten as it is a very important factor, in fact as important as a drain. Many track scales are going to ruin for the want of proper ventilation.

I find an excellent way to ventilate rigid deck track scales: placing ventilator in top of side walls and imbed three-quarter inch rods about two inches apart over the opening, bending ends down to hold firm in the concrete. These can be covered by wire mesh if desired.

The scale house or beam box should also be ventilated, as in many instances we find the beam and expressly the shelf lever, wet and rusty from not having the proper ventilation, and more so in the Southern climates.

This as well as the proper drainage is very essential in the construction of and the installation of track scales.

I also find in finishing concrete work on pedestals, for stands and on side walls, for eye beams or any place where there is weight and vibration, it is not well or good to follow the rules so much practiced in making a separate finish or layer of concrete from one to two inches thick. This often proves to be unsatisfactory, for after hard usage it will show that there has been some air left under this layer which had prevented it from knitting and it will crack and scale.

I would suggest that all finish of concrete for bearing parts be made from the natural concrete as the walls and pedestals are built of, omitting some of the larger gravel or crushed rock that would not pass through a two-inch ring, the concrete to be used up to and within the last six inches, where a finish is to be made, and in so doing we have a solid concrete.

If this is all well done and the pedestals are dressed to a perfect level, the placing of the scale irons will be easy, as the scale irons are all fitted and marked so plainly it is almost impossible to go wrong in this. The main part of this is to handle the material properly and carefully and not allow sleeves or adjusting parts to be moved and use the proper precaution in driving and setting pivots in coupling and hanging of scale levers and to see that all connections are plumb, which if the concrete foundation of stands and anchor bolts are correctly set, there should be no variation to these parts.

The bridge or main eye beams when fastened together should be lined and squared to perfect, and bearings to have an equal weight, and full bearing on all levers.

Check rods should be so adjusted as to allow three-sixteenths inch clearance and the end of the anchorage one-quarter inch lower than at the bridge.

Ties placed between bridge and rail stands should be of good seasoned oak and should extend at least three inches over the eye beam at each end, to prevent crushing the ends of the ties as the pressure is outwards on all rails, and it is well to have one pair of stands out of every five, drilled for a one inch rod as close to top of stand as decking will allow good clearance, thus anchor the stands together to keep the scale rails from spreading and avoid having shield plates to come in contact with scale rails.

Proper care should be taken in placing and securely fastening the scale rails to prevent them from creeping, and approach rails where points or other devices are not used, such as joint ease and so forth, the rails should not be laid too close, that is the joints should not be tight for a considerable distance on the track from the scales, and the rails well fastened and anchored on concrete approaches, which should not be less than ten feet when approach ties are securely set in concrete.

Leads to track scales should not be less than 75 feet from scales and should have 40 feet of tangent track from ends of scales.

Scale house, seven feet by twelve and one-half feet is sufficient, the room to be properly lighted, with a trap door in the floor leading to the well where an iron ladder should be provided for going down in the scale pit.

A type registering beam, as preferable, to avoid mistakes and keep an accurate record of weight is recommended.

Automatic weighing and recording devices for general use of railroad track scales are not desirable. As a general rule cars are weighed and handled over the scales in all different kinds of positions, to the best advantage in dispatching cars to classification tracks.

The only places where automatic weighing and recording devices can be used and give satisfaction are at coal and ore mines, with a fixed track with the necessary grade on the track approaching the scales by gravity, so that cars pass over the scales at a speed not to exceed FOUR miles per hour.

In maintenance of track scales much depends upon the location, ventilation and drainage, but more so upon the weighmaster, and the care they are given by those in daily charge, to see that they are clean and in proper condition for weighing and not allow long strings of cars to be run over the scales, nor should cars be bumped off scales, violently stopped on the scales by sudden application of brakes, or by throwing obstructions under the wheels and numbers of other damaging practices to cause injury to the scales, which at many places is not prohibited.

If all those that are interested in weighing, maintaining, installing and manufacturing scales, as well as the shipper and those that receive the revenue from weights, would study the motto of even balance and assist in maintaining the same, which is the most accurate weight that can be obtained, and by this method alone, even balance, which has many meanings, but the most practical amongst men, should be equal justice and fairness to all.

J. B. ANDERSON,
Scale Inspector.

Mr. Bowles, secretary, read the paper which was greatly appreciated by the overwhelming applause of the audience.

President: The secretary has a paper here prepared by Mr. W. H. Ragsdale of the I. & G. N. Ry., taken from papers read at American Railway Bridge and Builders' Association held at Montreal, Quebec, October, 1913. If he is present I would like to have him read it. Mr. Ragsdale started to read the paper but owing to a weak voice requested that the secretary relieve him of the task. Mr. Bowles then read the remainder of the paper which was as follows:

Mr. President, Ladies and Gentlemen:

As most of you know I am from the State which for more than two months has been attracting the attention of the whole world on account of its nearness to our friend, Huerta, and as my work has often carried me to the very scene of trouble, I have thought several times that I would not be able to keep my appointment here, for on more occasions than one I have barely escaped capture, and then at other times I have almost been pressed into service for Old Glory. I would like to tell you some of my experiences, but cannot on account of the time limit, known down in Texas as the 9:30 law.

Gentlemen, there is so much to be said about the installation of track scales that I hardly know where to begin. It is a well known fact that weights and measures have from time immemorial given standards for the traffic of the world; they antedate the use of money of any sort. No satisfactory history of weights can be compiled and the true values of ancient weights are as uncertain as their origin. The Egyptian supposed he got the balance from his God; the Babylonian would say his wise men invented it; the Israelite traced it back to Cain.

The earliest illustrations of the process of weighing are found on the Temple Walk of Egypt, dating back to the Rameses and the Thothmes Kings. Here the balance appears, having gold rings on one side, counterposed by a weight in the shape of an ox head on the other. The Homeric ox unit has been calculated as on an average equivalent to 135 grains of gold. The most accurately defined weight is probably the Babylonian Mina, discovered by Petrice in Egypt, and now deposited in the British Museum. According to Layard's table this Mina seems to have approximated that of a pound avoirdupois.

As you know the Chaldeans were experts in science; their metric system of time reckoned by sixty's has never been improved upon. Many supposed their weights and measure system to have been upon the same basis. The weight of a cubic foot of water was originally introduced by the Chaldeans.

The process of weighing first appears on the page of written history in the record of Abraham's transactions with the sons of Heth, the 400 shekels which he paid them for a burial place were weighed out in a balance.

Moses had a set of weights also of measures deposited in the tabernacle under cognizance of the priests; these were the authenticated standard to which all must conform. We also find that the oldest specimens of standard weights now in existence are those constructed by Queen Elizabeth and date back as early as 1586. From these English Standards, the American Colonies took their standards, and from the time of the founding of the American Colonies up to the year 1830 we had many improvements of the old British standard; we even had several inven-

tions for the weighing of commodities upon scales having a platform, supported by levers from underneath, but the first platform scales which were commercially successful were as you know, those patented by E. & T. Fairbanks at St. Johnsbury, Vt., in 1831; these scales were found in common use on coal roads in the territory east of Pittsburg and Buffalo, but it remained for the Empire Transportation Company (which was an organization of the officials of the Pennsylvania Railroad, with a few merchants of Pittsburg) to demonstrate the value of track scales, on account of the widely different weights and in protection to themselves they installed track scales at Erie and Pittsburg, and by rebilling and collecting freight charges on underbilled freight they had returned to them more than \$100,000.00 the first year. Such lessons were not to be ignored and the installing of track scales has spread rapidly ever since.

Now, gentlemen, it may seem to you that this subject which consists of nothing more than a pit with some casting in it, is not so important, but from the history I have given you concerning weight, we easily see that it is a subject which has been occupying the minds of thinking men since the time of Rameses, the great Egyptian King, possibly there is no other subject that men have tried so hard to solve accurately; when we consider this fact, and when we consider the fact that during the year 1912, there were moved by the R. R. S.'s of the U. S. alone, 25 million cars loaded in carload lots, and that the freight charges on these were estimated at one billion dollars, each track scale weighing 8,300 cars and measured \$332,000.00 of revenue. If one of the scales weighed this amount one tenth of one per cent under actual weight the road owning it was loser to the amount of \$332,000. At this rate the road could well afford to buy a new scale every year, and a very high class one every two and one-half years. Consider these facts, gentlemen, and don't you agree with me that this subject of accurately installing and correctly maintaining the track scale, is one of the greatest problems before us.

Bear with me a little while longer and I shall try to tell you in a few words the valuable things that I have learned by many years' experience on this subject. To begin with, let us take up the matter of location:

First, you should decide the type of scale and pit; if the scale is to be used for spot or motion weighing; whether it is to have overhang to the scale rails; and if so, how much? Whether or not a dead rail is to be used and if a pocket track is to be provided; with these points, decided it is well to have a consultation with the yardmaster and others likely to be interested in the use of the scale, as in this way some points may be brought out, which would affect the location of a scale. Prominent factors to be considered in the location are: Convenience in switching facilities and handling cars between the scale and yard tracks, track connections, gradients, alignment track spacing, drainage of scale pit, length of scale tracks and numerous other little details might be mentioned. The scale tracks should be of convenient length, but not so long as to be wasteful of storage space in the yard. The location of the scale should be such that trains using it will not interfere with streets or road crossings.

Plans and profiles should be made by the engineering department, and should contain all the information required for preparing the estimate of cost. The cost and the amount of the construction work may vary considerably according to whether the scale is to be used for spot float or gravity weighing. The location and grade of the scale track and pit and also the drainage system, should be set out on the ground by the engineering department.

Special consideration should be given to the drainage, and if there is doubt as to proper drainage or as to the bearing power of the soil, a test pit should be dug and the soil formation noted. The elevation of ground water should be ascertained also and levels taken along proposed lines of drains from the scale pit to the outlet, if this outlet discharges into a natural waterway, note should be made of the high, low and ordinary elevations of the water line, and their relations to the grade and the pit. Where a tile is used, it should start with its upper end not less than six inches below the bottom of the scale pit, and should have sufficient fall to give free flow for the water. Grades of four to seven inches per 100 feet are used in many cases. If proper drainage cannot be obtained, the scale pit should be made thoroughly waterproof and a pump provided for removing any water that may enter.

For the foundation, if test pits are not dug, the soil should at least be sounded with rods to determine its character and sustaining qualities, and the foundation proportioned accordingly; let me state here also that either cut stone or concrete foundation laid in accordance with best engineering practice, is indispensable factor in the proper installation of scales.

All foundations should extend to at least eight (8) feet, six (6) inches below the surface if an eighteen (18) inch reinforced concrete mat if a twenty-four (24) inch concrete mat (not reinforced) is used; or to a depth at least nine (9) feet below the surface if a twenty-four (24) inch concrete mat (not reinforced) is used; except where rock formation is found. Where rock formation is found, the foundation walls and piers may rest upon said rock which must be taken out to furnish a pit at least seven (7) feet deep from base of rail to floor of the finished pit. The pit floor should be cemented over with a smooth coat of cement and must be slanting to a common point of drainage. Sufficient excavation in such rock formation must also be made under each pier so as to insure the proper footing for the pier to prevent its shifting.

All scales should be set high enough on foundations so that surface water will not run into scale pit.

If the foundation is to be placed in soft, marshy or filled ground, a sufficient number of piles of sufficient length must be driven under each bearing pier and walls, to secure a perfectly solid footing and to prevent any settlement of either piers or walls.

If not on solid rock, a concrete mat twenty-four inches thick, if not reinforced, or eighteen inches if reinforced, should be laid somewhat larger than the outside walls, including the neck walls. The building piers and all walls must rest upon and be formed to the mat.

The side, and neck walls should be at least twenty-four inches wide at the bottom and at least eighteen inches wide at the top; the batter being on the outside of wall and the surface of said batter should be smooth.

The approach walls should be at least six feet long at the top and seven feet long at the bottom, measuring from the inside of the end walls, and must be formed to and made a part of the end walls; batter on the outside and said batter smooth.

Provision for pockets 12 inches wide by 12 inches long to a depth of the I beam used should be made in the top of the side walls for the

placing of the ends of the transverse I beams on which the top planking or deck shall be laid and to which I beams a dead rail can be secured.

When a dead rail is used these I beams should be of a sufficient size and number to carry the load. If said I beams are to serve as supports for top planking or deck only, then the size and number thereof may be reduced accordingly. They should in all cases have a bearing of at least 12 inches on each side wall.

In dead rail construction, a steel plate three-fourths of an inch in thickness, 12 inches by 12 inches should be placed in the bottom of the pockets even with the inside line of the walls, on which the ends of the I beams shall rest. These plates are to be held in place by two bolts or pins at the back thereof, without interference with the base of the I beams. **THESE PLATES SHOULD NOT BE FASTENED TO THE ENDS OF THE I BEAMS.**

The space of these pockets around the ends of the I beams may be left open or unfilled, or if it is desired, this space may be built in with brick or concrete even with the inside line of the walls.

The so-called "neck walls" should be a solid extension of the side walls next to scale beam and must extend far enough to form a foundation for full size of scale house, which scale house should be not less than four feet wide, and, of course, must be long enough to cover scale beam without touching the shelf thereof.

The neck should be covered with a concrete slab which will form the floor of the scale house, and a six-inch hole for the steel yard rod, and two one-inch holes for the pillar bolts must be provided in said slab.

The foundation piers for the scale section frames to rest on must be set so that the tops of the piers will be at least sixteen inches in, horizontally, from both end walls and side walls and these piers are to be built up to a height so that the scale section frames will rest on them, at a proper height without the need of timber, steel or shimming of any kind. Piers are to be finished smooth and have a four-inch batter on all sides and the top of each pier must be four inches larger each way than the casting that rests upon it. There must be three piers for each scale section frame; one under each end casting, and one under each center casting on said frames.

Anchor bolts should be set in the piers to match all bolt holes in the scale section frames. These bolt holes should be two inches in diameter for adjustment of frames each way. Preferably, these anchor bolts should be set in one and one-half inch iron pipe, which pipe should be set down into the pier approximately 12 inches, so as to enable slight adjustment of the bolts inside of the pipe when setting the frames. The inside of the pipes, after scale has been set, should be filled with cement.

If the scale is of a type that has main levers that hang below the scale section frames, recesses must be left for the butt of main levers in the front of each side pier. These recesses should be of a size to give a clearness of at least one and one-half inches around the levers and must be so formed that the bottom of said recesses will be on an angle of 45 degrees downward from a point under butt of main levers.

If there are any floating levers in the scale, that is, any lever on which the pull is upward at the fulcrum, steel rails or I beams should be built in the foundation mat, at the bottom of same, in the proper position to receive the fulcrum eye bolt or anchor bolts as the case may be.

The scale section frames should be set squarely on the concrete piers without shimming of any kind; must be set level and lined up to center. All scale section frames must be secured to the piers by the bolts already provided in said piers, and the bolts must be drawn down tight.

All connections should pull perfectly plumb and all pivots should be driven in tight.

The scale beam should rest on a shelf placed on iron or reinforced concrete pillars, and should be supported by iron stands that rest on said shelf, and no part of the shelf, pillars or beam supports, shall touch walls of scale house.

In all cases, the scale beam shall be so placed that the weigher when weighing a car will stand in a position facing the scale platform and have full view of same.

If scale beam is an elevator, mill or other building, not a regulation scale house, it should rest on a foundation independent of the building.

Extension levers to scale beams are very unsatisfactory under any circumstances, but where a set of extension levers are to be used, they should be as substantially set as the other levers in scale by means of concrete or steel, and should be hung from supports and rest upon a foundation independent of any building through which they may pass or extend into.

The platform should be made up of steel I beams tied and braced together with steel cross bars; said I beams to be not less than eighteen inch I beams or heavier I beams, when shown necessary on account of the loading.

The bearing plates must be bolted to the platform I beams so that said bearing plates shall rest properly upon the main lever pivots and all bearings must bear equally upon their respective pivots when platform is in place.

If check rods are used, they should be level and have one-eighth inch play when the scale is loaded or light.

Short cast iron pedestals should be used under the live rails and should rest upon sound wooden ties. These pedestals are to be held in proper position by means of bolts that extend to the basis of the pedestals; the wooden ties and the flange of the I beams.

The live rails should be securely bolted to the short cast iron pedestals, or if it is desired they may be fastened to the pedestals by means of malleable iron clips, provided that a sufficient number of anti-rail creepers are used to prevent any creeping of the live rails. The opening in the solid deck along the live rails and pedestals should be covered or protected.

The flooring of the solid deck should be made of at least two-inch planking, surfaced, matched and laid with white lead and horizontal clearance must be given in said deck along the live rail pedestal. At the very least, two inches clearance must be given between bottom of solid deck I beams and top of live rail platform I beams.

Switch points should be used at the ends of the lead rails and should be fastened to the end walls by bolts set in said end walls, and the dead rail, if dead rail is used, should be securely fastened to the end walls by bolts provided therein. This arrangement is necessary to prevent the lead rails from crawling toward scale and producing a binding effect against the ends of live rails.

All scale beams should be type registering, full capacity beams and no extra or additional weights to raise the capacity.

The counter-balance weights, if any are used, should not be slotted, but should be furnished with a hole in center through the hanger stem shall pass and the cup for balancing the scale shall be below these counter-balance weights, with the weight resting on top of cup.

In conclusion, and as a general summary of this paper, I will say; scales should be installed with dead rail or relieving apparatus; the deck of scales should be of the rigid type and should be as nearly dirt and water proof as possible. Scales for spot weighing should have the scale rails level and approach rails level with them for a distance of about at least 50 feet. For motion weighing scales, rails should have a grade not greater than one per cent. Means of adjustment used to secure a uniform distribution of loading, should be set as low as possible when installing as yards are raised more than lowered. Wooden ties between weigh-bridge and scale rails, should be used and should not be framed until the bridge is installed. Scales should be set directly on foundation or on metal bed plates resting on foundation, the anchors provided should have slight adjustment laterally and longitudinally to permit a changing of scale parts. Scale beam supports should rest directly on foundation. A clearance about working parts of the scale should be three-quarters inch except that rails of approach when properly anchored, may have not less than one-half inch. Approach and scale rails should be anchored so as to prevent creeping. Scale pits should be heated if necessary; ventilation of scale pits should be provided. Scale pits should be lighted, should have scale houses, and by all means, have adequate lighting inside and outside of scale house where night weighing is done.

I would like so much to discuss with you, the maintenance of scales, but time forbids, and so as a parting sentence I would say to you, ask your scale inspector how the scales on his system average.

President: Mr. Bohannon has a paper prepared by Mr. Neal Dugger, Scale Inspector of the Tennessee Coal, Iron and Railway Co., which I would like to have him read. Mr. Bohannon then read the paper which was as follows:

TRACK SCALES.

THEIR INSTALLATION AND MAINTENANCE.

The history of the earliest people records the using of a system of weighing and measuring. The devices used first for weighing were balances of two classes, similar to those now in use; namely the even balance and the steelyard.

With the passing of the years and the advance of civilization, we meet the necessity for heavier scales and greater accuracy. Today our scales range in capacity from the one which records the weight of a single sun beam to that one which weighs objects of several hundred tons.

It is not my purpose in this paper to deal with scales from a purely scientific stand-point or to weigh the sun beams or moon light, but rather to deal with the practical side of the question and decide if possible just what must be done to increase the efficiency of scales now in use, and to get before us some idea of what the general weighing conditions requires today.

We expect to deal with a very small part of the weighing system, but one which is receiving the undivided attention of the manufacturing and shipping interest of the U. S., namely, track scales, their installation and maintenance. The first track scale made its appearance in the early sixties. Though crude in its construction and design, it proved greatly superior to the former method, and even though inaccurate then, it has become of prime importance to our railroads and manufacturing industries.

Following the introduction of the track scale, considerable trouble was experienced due to various causes which brought about an investigation of the track scale situation in the seventies. After this investigation, more attention was paid to the proper weighing of cars and especially to the method of testing and inspecting scales.

Some railroads placed test cars in service at this time, similar to those used today. During the next period of time, the scale situation failed to progress sufficiently to meet the requirements of the ever increasing growth of the railroad equipment. Up to this time not much attention was paid to the installation of scales, and it was generally understood that anybody from a mason to a blacksmith including the carpenter and section-hand was competent to install the scale. As a natural consequence, scales were installed, hit or miss fashion, and any way to get the job done, practically little or no attention being paid to the first principles of correct scale installation.

I have actually found scales installed by the aforementioned workmen, with levers upside down, with suspension loops friction side out, and iron frames for long levers in the place of those for short levers, this error most frequently found in five section scales. These are only a few of the defects scale men find from time to time. The average mechanic not being acquainted with scale work, has little or no idea that levers should be levelled and that loops and connections hang plumb.

As a result of this putrid installation on the part of the user, together with insufficient capacity and incorrect design by the manufacturer, conditions became such as to necessitate the government's making an investigation. We have thereby, recently passed through a series of illuminations such as never before were presented.

At the conclusion of the Interstate Commerce Commissions investigation, it was reported that 75 per cent of the track scales were weighed in the balance and found wanting. Previous to the investigation, however, some railroads found themselves fully justified in accepting the advice of the practical scale man, who in connection with the engineering department designed and installed scales which proved an unqualified success, both from a standpoint of accurate weights and cost of maintenance.

This, of course, meant an increased earning power for the scale, as claims are rarely settled where scales are known to be reasonably accurate. Though not directly a revenue producer the track scale governs the amount of revenue, and should therefore be correctly installed and maintained.

No man is sufficient unto himself in perfecting a device as shown by examples such as the Westinghouse air brake and the modern locomotive. Westinghouse has not taken nor justly deserved all the honor connected with the development of the air brake, but has depended largely upon the theory of the one and the technique of another of his

associates. And the locomotive is a monument to the minds of many men since the days of Stephens. So the best results, in scale work, have been attained when the manufacturer, the practical scale man, and the engineer have joined hands to work out a better scale condition. It is the utmost importance that we do not overlook either the manufacturer with his experience and facilities, or the engineer with his scientific knowledge, or the practical scale man, with his knowledge of requirements and his previous experience with the performance of the different types of scales.

In speaking of that scale which will meet the requirements of today to the best advantage, there are several points to consider. Naturally we first demand practical accuracy and consistent weighing, which is brought about only by conditions most favorable. First we must have the proper design of scale, and its location should be accessible and convenient for the handling of such material as must pass over it.

That type of scale is most desirable which has levers of sufficient capacity to prevent deflection under heavy loads since rigidity prevents erratic weights and enables a light load and a heavy load to be weighed with the same precision, other things being equal. To assist in gaining sensibility of the scale steel friction plates should be provided. In order to facilitate the installation, levelling tabs should be on the levers, the bearings should be of the suspension type as scales so equipped produce less wear on the pivots. Compensating bearing blocks should be used in order to secure perfect alignment.

A full line of bearing is preferable for pivots because they are more accessible for inspection and not apt to collect dirt. The rigid platform is strongly recommended because its commodious pit facilitates inspection and repairs. The lighting and heating of pits should not be neglected and the painting of the structural work is of great importance. Having selected the type, we should not overlook the devices designed to protect the scale such as the flexible girder and the easer joint.

The former is advantageous in that it enables each section of the scale to carry its part of the platform and load, whereby a positive bearing is maintained over each section and it is claimed that this prevents the wear on pivots. That this has made good in its pretensions is shown by the fact that several railroads have adopted it, and one railroad has now in or under construction twenty scales with the Flexible girder. So far as possible wood should be eliminated from the construction of scales, it being a source of annoyance because of the frequent renewals, all this being unnecessary when a properly designed device is used to eliminate the pound at the open joint.

Since the introduction of the Easer Joint, it is possible to place a car on the scale without jar or pound.

This in itself is enough to recommend its use upon every scale. But it has other advantages; it lands the car on the scale gradually, thereby reducing the wear on the pivots, giving greater efficiency and lessening the cost of maintenance.

While the Easer Joint is not a cure for all the ailments of scales, it is recognized by the foremost scale men and engineers as an adjunct of inestimable value which railroads have been quick to appreciate, more than thirty railroad manufacturers having adopted this joint.

This is a day of specialization. We no longer tolerate the Jack of All Trades and Master of None. He who would accomplish much must

prepare for some particular work. He who is most competent to have charge of the installation of the scale designed and equipped according to best opinion of today is the special scale man.

This specialist in scale work knows and when a lever is properly gaged and sealed, he knows the multiples of the various levers, and is not apt to place a main lever where the extension lever should be. He knows when a pivot is properly tempered, and is not likely to drive one in upside down and break a lever. The specialist in scale work knows what will be required of the scale as well as possessing some practical engineering knowledge, and is therefore of more than ordinary value to his employers. Then, too he can handle his labor in that manner which will get the most work in the least time.

Until recently, but little attention has been paid to the maintenance of track scales. This was evidenced by the findings of the Interstate Commerce Commission, and the inefficiency of the scales in general. A few years ago \$1,800 to \$2,500 was a big price to install a scale, but now we hear that installation ranging from \$5,000 to \$20,000, and even more in some cases have been made. When an installation of \$1,800 to \$2,000 is made, the maintenance is a serious problem, but when a heavier scale is chosen and the cost of installing thereby \$5,000 and upward, the cost of maintenance is greatly minimized.

The former practice is fast becoming obsolete. This is being brought about by the lack of room for inspection and repairs, and the equipment having outgrown the scales. It has been my experience that it was not only inconvenient, but it has been an expensive practice, and all of you whose duty it has been to replace levers, pivots and links, etc., will readily agree that it is both expensive and inconvenient to repair some of the cheaper scales where room is at a premium.

Much of the difficulty is eliminated where the proper consideration is given the installation of the heavy type of scale. The parts being heavier, the bearing surface greater, the scale is much stronger and will last longer and the necessity of repairs is largely obviated. However, when necessary to repair this kind of scale, it can be done with some degree of satisfaction and personal comfort.

Maintaining scales should include regular testing and inspecting and their records kept from the time of installing until they are removed. Various methods are used for testing scales, the most popular and practical being the use of a car with a short wheel base which is placed over each section of a scale. This enables us to ascertain at once just which section of the scale is in error.

The frequency of these tests should depend largely on the commodity weighed and the amount of usage of the scale. In railroad practice, once per month is generally considered enough, but in most of the mills once per week is the rule. No proficient scale man will fail to thoroughly inspect the scale at the time of testing. In this inspection we find a two-fold reward.

The first to the inspector since he becomes familiar with the general condition of the scale, report of which he could not make without this knowledge. The second to the shipper for whom it avoids a break down or inaccurate weights. The preservation of pivots should receive our most careful attention, as it is wasteful to install a scale and then through neglect condemn it to the scrap heap.

After the selection of pivots, steel which meets the requirements for hardness and toughness, giving the wearing surface and strength, it is another proposition to make it last, as ordinarily it is subject to the elements and would naturally become worthless without a single car passing over it, it left to take care of itself. I daresay that scales would last twice as long as engines, provided they received proportionate attention. How many scales do we find with loops and bearings as free from the filth as the main shaft on a stationary engine?

Several methods are known that will keep pivots clean and free from rust. First and best, is to clean them. At some places scales have been equipped with air for the purpose of regularly cleaning pivots, bearings, loops, etc. This has proved a very effective method where a small amount of oil has been mixed with the air, thereby leaving a coating of oil on the finished surfaces to prevent deterioration by rust.

Track scales have been successfully equipped with relieving gear. Much can be said in its favor from a safety first stand-point. It is also claimed that there is less wear on the pivots where scales are so equipped.

We may not have been able to present anything new to scale men of such prominence as those in this audience. You are no doubt entirely familiar with the recommendations of the American Railway Association, and the proceedings of the American Railway Bridge and Building Association, in addition to your personal experience. However, I hope that we will be mutually benefited by having been associated together.

Papers by Mr. E. J. Woods and Mr. C. E. Stover, both of the Missouri Pacific Railway were received, but not read which were as follows:

Paper by Mr. E. J. Woods:

Ladies and Gentlemen:

Briefly I am in favor of a 50-foot 4-section 150-ton scale, suspended type, rigid deck, 24-inch 120-pound scale I-beams (or supports for scale track), concrete foundation and good drainage.

I do not think the above plan should be varied from only in very rare exceptions.

The above may sound a bit radical or extravagant, unless the subject is gone more into detail than I can attempt by this paper. But I will here state a few of the principal reasons for reaching the conclusion that such scale should be generally adopted.

We will first say the cost is double over that of a 40-foot 4-section 100-ton scale or that one cost \$2,000 and the other \$4,000; then what do we get for the \$2,000 additional cost?

With the \$4,000 scale you have something that no road or industry can improve upon or dispute, and the life of the scale, the moral effect alone is worth the difference in the cost.

Shippers who see or learn of such scales being used are pleased, and feel less disposed to file claims because they could not prove they had checked the weights by a better scale. I saw a car weighed at night on a 40-foot scale, weight taken with one pair of wheels off the scale. This car was a long haul of high class freight and the error meant a loss of several dollars. With a 50-foot scale much money is saved via elimination of delay in spotting cars, and insures that cars are cut at one end which is important.

A 50-foot scale will permit the attachment of easer rails of any design at each end of the scale, and yet leave ample space for spotting cars quickly. With such a scale it is a rare occurrence that a car must be weighed half and half.

With a 150-ton capacity, vibration is reduced and a degree of accuracy and length of service is increased.

It has been demonstrated that the life of a 100-ton scale is short when subjected to weighing cars that the majority run near its capacity. The 150-ton scale would meet the 100 or 90-ton cars without injury if they come.

Track scale weight recording attachment will, I believe, be more generally used in the future. A 150-ton scale properly installed will meet the requirements of these machines without additional expense or preparation.

It is a well known fact that the road that has all or nearly all of its track scales of a uniform character can maintain scales at a minimum cost, since all parts are interchangeable.

We can best realize the value of a reliable scale when we think what one pound light in one thousand pounds means. It is equal to one hundred dollars loss in each one hundred thousand dollars track scale freight. At this rate we have stations where the loss would be eight to ten thousand dollars per year.

The rigid deck. This has many advantages over the deck attached to scale or the floating deck, namely: it is less liable to change balance of scale in extreme wet or dry weather, wind pressure is reduced, there is less danger of deck binding. Pit and scale parts are easier kept clean. Men will sometimes unthinkingly walk onto a scale deck while cars are being weighed. Coal, stone and so forth is sometimes jarred off of cars onto the deck, or snow may cover the deck several inches deep, but unless these things are resting on the scale rails it does not interfere with correct weight with a scale of the rigid deck construction; although the scale deck should be kept clean at all times regardless of the above. A rigid deck laid on cross I beams of sufficient strength to carry the dead track leaves nothing in the pit except scale proper and gives easy access to parts for inspection and repairs.

The four sections reduce parts to a minimum, incidentally reduces parts to cause friction, inspect and repair. I do not favor a location where it is necessary to use an extension lever between the fifth lever and shelf lever for the same reason.

Suspended type. Means that the bridge or parts supporting scale rail is suspended from instead of resting directly on the fulcrum pivots in the main levers. With the suspended bridge and easer rails to relieve the strain from the end section, it will be found that many years' service can be had from a scale of concrete and steel construction without cause to question weights or expense for repairing, deck ties, main levers, or other parts would soon become pounded to pieces under heavy traffic where easer rails are not in use. I would advocate easer rails as one of the necessities in installing all 50-foot scales. I would propose as a part of the standard that the approach tracks be supported by concrete walls for a distance of at least fifteen feet from the ends of scale, a car length would be better. This would insure that the approaches would be kept up and would also give an opportunity to anchor approach rail which in most cases give trouble at different times by binding scale rails,

to say nothing of the many other advantages to be had from good approaches.

I would favor good drainage and good lighting facilities in all cases, and that scale beams be of the type registering of not less than 200,000 pounds capacity, located when possible in a house well lighted, rather than in a beam box.

I do not wish to go into detail in this paper, as I do not want to tax the patience of the members, but feel they will be found equal to the occasion of giving details on construction and be prepared to answer any questions as to why such details are needed.

Summing up I feel that it would be long distance economy from most every view-point to ask that the scale briefly described in the beginning of this paper be adopted as a standard throughout the country. However, I am open for conviction, and if a better plan can be finally agreed upon, I am ready to adopt it.

I sincerely regret that I cannot be with you on the 6th, as I feel there is much that I can learn by being at the meeting.

Paper by Mr. C. E. Stover:

Ladies and Gentlemen:

In view of the fact that this association is composed of practical scale men who have years of experience, and have formed this association for the betterment of all conditions pertaining to this line, it becomes the duty of the members to set forth the most essential points in the construction and maintenance of scales.

I shall therefore, mention the foundation and work pertaining thereto.

First. The excavation must go down until firm ground is reached or drive piling, and if piling is used they should be entirely covered with concrete, thus preserving them from decay and forming a base for the piers for the scale to rest on and also for dead rail stands or I beams. All forms should be made perfect and set accurate and firm in order to avoid shifting or settling out of position, and all bolts used in anchoring both scales and dead rails should be carefully set and properly taken care of in placing the concrete, as this will insure a more correct setting of the iron which is absolutely essential to obtaining correct results after the scale is installed. All scale section piers must be level at the top with each other so that all affected points in each lever will be level and all connecting links and hangers must hang plumb so that the load on the scale will have the proper purchase on the beams and the figures shown thereon will be positively the correct weight of such draft.

I have advocated the use of concrete for foundations, because it has been my experience that better results were obtained after scales are installed, both in regard to weights and durability. While there are some bearing points that may wear faster by being on so firm a foundation, the percentage of better results will more than off-set the cost of changing such levers and replacing with new instead. In case it would be impossible to excavate deep enough to strike firm ground or drive piling either, it would be necessary to greatly reinforce the concrete with iron or steel rods so as to insure sufficient strength to resist breaking or cracking by the traffic passing over scales or dead rail because a break in this work is proof that the bottom is giving away, and in such cases the scale sections will go out of level, and it will be impossible to obtain

correct results in weighing, and the all important question is absolutely correct weight and it is for this reason that the use of scales have become so great a factor in the business concerns of today.

President: We have with us Mr. D. B. Gordon of the Pennsylvania Line, and I am satisfied that he has something interesting to tell us. Mr. Gordon arose and said he did not have anything to say at this time. The president then called on Mr. W. E. Dunlap of the Baltimore and Ohio Railway.

Mr. Dunlap made some remarks about the efficiency of scale work which he hoped would be accomplished. He was applauded at the conclusion of his talk.

* President: We have with us Mr. John Dower of the Merchants' Exchange Weighing Department, St. Louis, and would like to hear from him.

Mr. President, Ladies and Gentlemen:

I did not expect to be called upon to make an address, but will say a few words. I see a great many men of experience in the audience; that is, with practical part of repairs and the manufacture of scales. I am connected with the weighing department of the Merchants' Exchange of St. Louis, and we, of course, look for results and anything that occurs in an organized body of men of this kind which is organized with a view of getting results, I am for them. (General discussion follows on Mr. Johnson's paper with reference to tolerance which the reporter was unable to record in detail.)

Mr. Dunlap of the B. & O. and Mr. Jackson of the Chicago Board of Trade made a few brief remarks with reference to Mr. Johnson's paper.

Mr. Klotz of the Southern Pacific Railway, of Houston, Texas, was introduced by the president and spoke about the organization of the American Scale Men's Association and related the objects and purposes for which the organization was formed, which was listened to attentively by the audience.

Mr. J. T. Heard, Birmingham, Ala., of the L. & N. R. R. Co., was introduced and spoke on what the inspector has to contend with while inspecting and testing scales along a railroad.

Mr. Bohannon of the Bohannon-Dugger Easer Joint Co., was then called upon and made a few remarks.

Mr. Will Ball, Superintendent of the Streeter-Amet Weighing and Recording Co., Chicago, Ill., was called upon and made a few remarks.

Mr. A. G. Zeibel, Oelwein, Iowa, of the C. G. W. R. R. Co., also made a few remarks.

Mr. D. J. McCarthy, Oelwein, Iowa, of the C. G. W. R. R. Co., was then called upon, but excused himself as he did not have anything in particular to say.

Mr. Otto Luecke of the Standard Scale and Fixture Co., St. Louis, Mo., made a few remarks about the construction of scales in general.

Mr. Wm. Rosenmeier, Howell, Ind., of the L. & N. R. R., and Mr. R. J. Dean of the Texas and Pacific Railway, Dallas, Texas, made a few remarks with reference to scales, etc.

Mr. Wm. Rivett of Lincoln, Neb., of the C. B. & Q. R. R., then arose and read a paper which was as follows:

The systematic maintenance, inspection and testing of scales has come only in the last few years. On some railroads twenty years ago, this work was taken care of very inadequately by section and bridge men. Now we have federal, state, city and the weighing and inspection bureau men to assist us, and call our attention to dull pivots, plugged weights, loaded poises, broken hinges, etc.

The maintenance of a track scale depends to a large extent upon the usage to which it is subjected. Good examples of the extremes are the modern master scale and the small poorly drained, unhoused and exposed track scale with no dead rail, subjected to weights 50 per cent over its capacity, and given very little consideration in regard to train movements over it. A great many train men are apparently of the opinion that a track scale, like a bridge, is not damaged by traffic as long as the rail does not sink.

The increase in the number of 100,000 capacity cars necessitates large scales. I think the present modern 4-section 50-foot 150-ton scale is meeting the requirements. The foundation for a scale of this size is of great importance. In one instance where we encountered very soft ground, it was found necessary to drive piling under dead rail walls as well as under sections of scales. It cannot be expected that a scale will be as reliable on wood foundation as on concrete.

I made a test of a 100-ton track scale with a 30-ton test car and obtained the following results:

First section 100 pounds heavy.

Second, third and fourth sections correct.

Fifth section 100 pounds heavy.

However, when a car weighing 120,000 pounds was placed on the scale it weighed 1,500 light. This was caused by a defective wooden support which had not at that time deteriorated sufficiently to create an error when a weight of only thirty tons was applied. Had we some means of obtaining a convenient inexpensive check of all weights, then the importance of these probable error-making constituents would decrease. We have several track scales in temporary locations and generally these are placed on temporary all-timber foundations. This kind of foundations should not be recommended even for temporary scales.

More attention should be given to the keeping of the scale pit dry. Not only is a wet pit a detriment to the metal work, but it rots out and swells the timbers as well as often causing the foundation to settle.

There can be a great improvement in the maintenance, inspection and testing of track scales by giving each one more time. One man is usually given more scales to inspect and test than he can do justice to. In 122 consecutive tests made with a steel test car, 26 were correct, 31 heavy and 65 light. The average error was 53 pounds light. The above included 60 railroad owned scales with an average error of 19 pounds light, and 62 privately owned scales with an average error of 86 pounds light. When a track scale is in error, that error has a tendency toward light weight. The loss of revenue to a railroad is an unknown item, though probably such as would warrant the expenditure of more money in attempting to keep track scales in reliable condition.

The location of a track scale is a large factor in its maintenance. Generally a test should be made at intervals of three months, a thorough cleaning (especially the pivots and bearings) and painting every three years with particular attention to the steel.

There is considerable difference of opinion in regard to the most satisfactory length of wheel base and weight of test cars. I think that the ones used by the C. B. & Q. R. R. Co. are practically ideal, being 65,000 pounds with a wheel base of nine feet six inches.

I have been deeply interested in the subjects of track scale tolerances. The maximum for this is usually placed at 100 pounds per 100,000 pounds. Experience has taught me that this should be increased and that 200 pounds would be more satisfactory. I have frequently found errors of 150 pounds to 200 pounds, and have not allowed an adjustment of the nose irons. In one instance in which the above conditions occurred, another test was made after three or four months by the same methods and no error found. No repairs or adjustments were made on this scale between the two tests. Take the average track scale, weigh a car, then run it off and on again immediately and you will not necessarily obtain the same reading. I also made a test of a new 4-section 150-ton scale with all steel test car, weight 65,000 pounds, and found the first section 40 pounds heavy. After four months the section recorded 65,000 pounds, having received no adjustments in the meantime. This scale broke readily on five pounds. Many a scale is damaged by excessive adjusting. I know of several instances where track scales have been ruined by too frequent moving of the nose irons. In 90 per cent of the cases in which the scale does not test properly, the trouble is not to be found in the nose irons.

I had an occasion to check over the books of a large elevator to get at some comparative weights. Out of 34 cars weighed on their track scale which is a very good one, and in first class condition, one car checked with the originating weights, while the other 33 cars varied from 40 pounds to 780 pounds, some over and some under weight. A great many of them weighed more at destination. I give this to illustrate in what condition some of these scales must be in.

My experience with wagon and stock scales has been very valuable to me in the twenty-seven years that I have been in the scale business. I find that a great deal of the trouble and discrepancy is caused by inexperienced men trying to build or repair them. I have seen pivots put in upside down, levers misplaced, steel yard rods not plumb, short platform bearings placed where the long ones should be, check rod castings misplaced, etc., and of course the scale is condemned instead of the builder.

I note in the pamphlet of Track Scale Specifications approved by the American Railway Association of November 19, 1913, has this paragraph: "Subject to such changes as may be required to meet local or special conditions." Or in other words I would say these specifications are merely suggestions, some of which I consider very good.

In closing I would respectfully refer you to an elaborate report on construction and maintenance of track scales in the Railway Age-Gazette of March 13, 1914, page 526.

WM. RIVETT.

Mr. Rivett was applauded.

Mr. C. A. Johnson of Rutland, Vermont, discussed his paper with several of the members present, but reporter did not hear discussion plain enough to get it in the proceedings.

After this discussion the meeting adjourned at 5:30 p. m. to be recalled again at 7:00 p. m.

The evening session was called by the president at 8:00 p. m. The regular routine of work was carried through. The association decided to hold their next meeting in St. Louis the first Monday in December, and to continue three days. The following were nominated for the offices to be elected at the December meeting:

For president: A. Christopher, Nashville, Tenn.; Wm. G. Klotz, Houston, Tex.; H. M. Bowles, St. Louis, Mo.

For vice-president: Mr. C. A. Johnson, Rutland, Vt.

For secretary: Mr. C. C. Royse, St. Louis, Mo.

For treasurer: Mr. J. B. Anderson, Mena, Ark.

For sergeant-at-arms: Mr. Wm. Sligar, Centralia, Ill.

Board of Directors: Mr. Wm. G. Klotz, Houston, Tex.; Mr. F. S. Elliott, St. Louis, Mo.; Mr. J. F. Pallardy, Kirkwood, Mo.

Membership Committee: Mr. John T. Heard, Birmingham, Ala.; Mr. W. H. Ragsdale, Palestine, Tex.; Mr. T. E. Kenworthy, Peru, Ind.

Ten new applications were acted upon this evening and were elected to membership in the association.

The meeting was adjourned at 11:00 p. m., after the president admonished all to be sure to be on time for the special train Sunday morning, June 7th, which left the Union Station at 8:00 o'clock sharp.

On Sunday morning the train left the Union Station with forty passengers present, first going to Dupo, Ill., where the Missouri Pacific have twin hump scales which were inspected by the members who made the trip. After this inspection they all then boarded the train, and the return trip to St. Louis was made. When the train reached Howard Station, Missouri, all passengers unloaded and lined up in front of the train where a picture was taken after which the train continued on to Pacific, Mo., where the members had the pleasure of inspecting the Master Scale and Scale Shop of the Missouri Pacific Railway Company, located at that point. At this place is where all scales of the Missouri Pacific Railway System are repaired and resealed. The return trip was enjoyed by all, as the Missouri Pacific Railway tracks ran along the Meramec River for quite a way and the river was lined with parties canoeing and bathing. Also afforded very fine scenery. The train arrived in St. Louis at 3:00 p. m., and the members adjourned to the American Hotel Annex where the banquet was held to forty who were all that attended. Some of the members left the city on Saturday night and others Sunday morning, not making the inspection trip with us.

During the banquet there were short addresses made by several of those present which closed the June meeting of the association.

H. M. BOWLES, Secretary.

F. S. ELLIOTT, President.



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